MODULE INTEGRATED

Discussion Lead: Sarah Kurtz, NREL
Tech SETA: Rusty Heffner, BAH
ARPA-E Fellow: Karma Sawyer

Breakout Session

8 February 2011

1. **For power converter technology, what are the drivers for module (backskin, junction box, frame out) integration?**
   - Total costs at system level (may not be primary metric, but need path to cost reduction)
   - Footprint (and integration)
   - Efficiency/Power yield of PV system is ultimate concern, but metrics may need to be defined at inverter component level (efficiency/power density of inverter)
     - Efficiency of tracking capability versus efficiency of power conversion
   - Ease of use/installation
   - Safety
2. For power converter technology, what are the barriers for module (backskin, junction box, etc.) integration?
   - "Big picture:" Cost, performance, reliability
   - Performance
     - Life is key: 25-year warranty is worth a 2X price premium
   - Yield & Reliability
   - Designs in passives that allow shrinking
   - Thermal management
   - Integration (Part count: SOA 50-500)
   - Manufacturability

3. Consider a strategy to address each of the barriers:

- Efficiency
  - Define efficiency as yield at module
  - Move to higher frequency and higher integration
  - **New magnetic materials, semiconductor devices, circuit designs that utilize them, packaging and integration**
  - Path for new technologies to come down cost curve
- Lifetime
  - Component design and selection: film caps preferred over electrolytic caps, traditional MTBF calculations are not enough
  - Reduce part counts
  - High-temp electronics not key thrust – don't want to operate at higher temps
  - New materials/components (wide bandgaps) must have 25-yr useful life; engineer and test to demonstrate extended lifetime – will need to prove it
- Thermal Performance
  - High ambient operating temperature requires even heat distribution
  - Use low-loss switches (GaN) or other material; running cold to increase reliability
  - Liquid-phase joints, more temp cycling insensitive
  - Metallic enclosure acting as heat sink introduces grounding problem; higher conversion efficiency avoids need for heat sink

4. Metrics: Power density, energy extraction and manufacturability